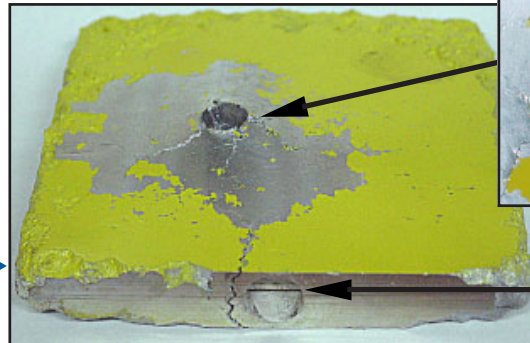


Staying Ahead of the Bullet

Low-cost transient liquid phase sintered aluminum oxynitride transparent armor



Captured rounds in encapsulated ceramic armor developed and tested at INEEL.



Armor Material and Manufacturing R&D

Supporting the U.S. military and government agencies with advanced armor solutions

For more than 20 years, scientists at the Idaho National Engineering and Environmental Laboratory have provided advanced materials and processing technologies for armor. The armor, used by the U.S. military and other government agencies, provides enhanced protection for vehicles, facilities and even personnel.

Advanced Materials

Better Protection at a Lower Cost

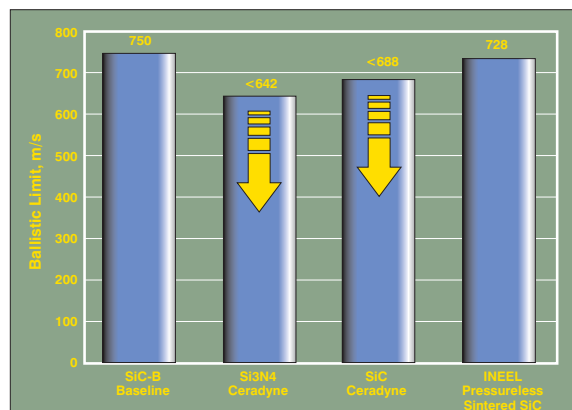
Providing low-cost yet effective armor products remains a commitment of our scientists.

In cooperation with an industrial partner, we developed a special high-strength, non-

brittle alumina and low-cost, pressureless-sintered silicon carbide (SiC).

The silicon carbide offers potential solutions for armor and high-temperature structural applications and compares favorably with other ceramic armor materials. Our pressureless-sintered SiC costs four times less in production than current processes.

We also have in development a transient liquid-phase sintered aluminum oxynitride ceramic for transparent armor applications at a low cost.



Ballistic performance of pressureless-sintered SiC compares favorably with other ceramic armor materials

Test round: 14.5 mm BS41 AP with WC core. All ceramic tiles bonded to 5083 Al backing.

Unique Resources and Capabilities

The INEEL has unique capabilities in armor material development, systems design and ballistic testing. We also work in collaboration with private industry and other government agencies to turn new processes into real prototypes.

The INEEL has complete materials science, engineering design, fabrication and assembly capabilities.

Material Testing

We have a full range of material testing capabilities. The tests range from standard, quasi-static tests to high-strain, rate-split Hopkinson pressure-bar testing at the laboratory.

Impact Testing

A state-of-the-art high-speed magnetic flyer plate impact tester is available. It is supported by laser Moiré interferometry and high-speed cameras to record shock wave propagation phenomena during impact.

Material Characterization

Extensive analytical and metallurgical laboratory capabilities, such as SEM, TEM, XRD and Auger for material characterization are available.

Computer Modeling

Computer modeling and simulation capabilities are used

for investigating impact phenomena in detail.

For years, we have used advanced hydrodynamic computer codes, such as CTH, DYNA, EPIC and ZEUS for modeling the design and verification of armor systems.

Live-Fire Test Range

The INEEL has an on-site indoor, mil-spec compliant test range for testing up to .30 cal. armor-piercing (AP) rounds and an outdoor range for 0.50 cal. AP rounds.

Additionally, we can perform live-fire testing with explosively-formed projectiles, shape charges, etc.

Our staff has the technical expertise for handling high explosives and disposal of spent targets to assist in testing.

New Uses for Technologies

Researchers are employing a unique INEEL-developed spray-forming process to create a patent-pending lightweight armor system for personnel and vehicle protection. The technology encapsulates ceramic

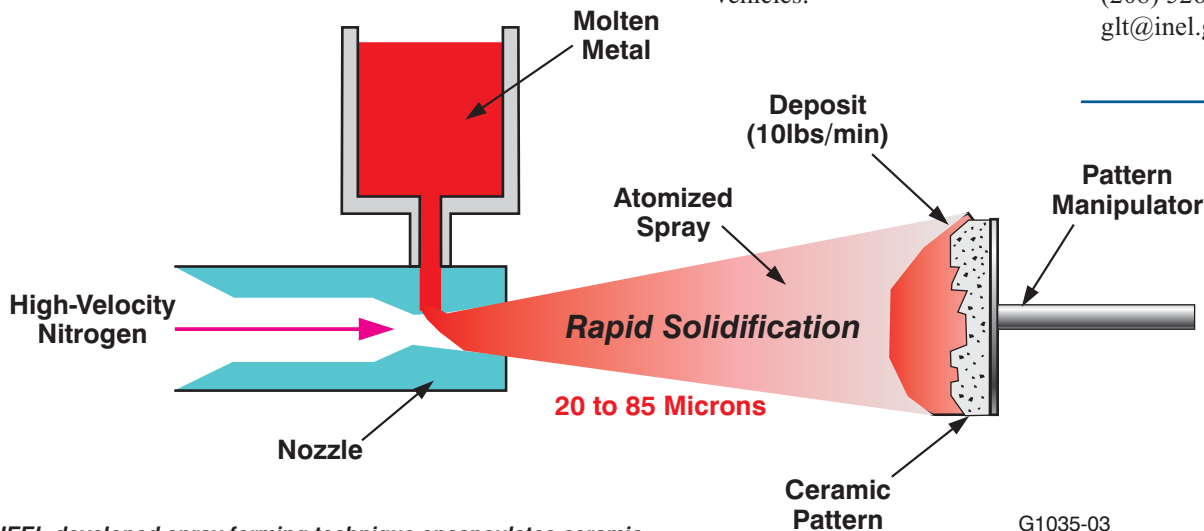
armor to provide a multi-hit capability.

The spray-forming technology also has applications for increasing the ballistic efficiency of commercial off-the-shelf materials and weldable ultra-hard armor steel for passenger vehicles.

For more information:

Henry Chu, Ph.D.
(208) 526-6405
chuh@inel.gov

Gary Thinnies
(208) 526-9298
glt@inel.gov



INEEL-developed spray forming technique encapsulates ceramic armor to provide a multi-hit capability.

G1035-03